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Discrete fracture network approach versus double porosity approach for groundwater flow modelling

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Two alternative models for simulating flow in a fractured aquifer are compared. The first approach relies upon a so-called discrete fracture network (DFN) which explicitly describes the fracture network embedded in a porous matrix. Flow is solved in both the factures and the matrix, and we present an original numerical solution to this coupled problem. Assuming dense fractured media in the second approach, also called double porosity approach (DP), flow is modeled by two continuous media: the first-one highly permeable is representing the fractures and the second-one with negligible flow representing the matrix.
We provide here numerical experiments of flow between wells in a five spot configuration to study the upscaling from DFN to DP. Pumping tests are simulated using the DFN approach and the parameters of the DP model are fitted on the drawdowns observed at different distances from the pumping well. The sensitivity of the fracture density and fracture hydraulic conductivity of the DP model parameters is analyzed, which leads to the definition of some upscaling criteria for this kind of configuration.

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